



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Susumu Takagi et al.      Group Art Unit: 1764  
Serial No.: 09/731,935      Examiner:  
Wachtel, Alexis A  
Filed: December 7, 2000  
For: **METAL COATED FIBER MATERIALS**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

DECLARATION

I, Susumu Takagi, do hereby declare:

1. I am one of the joint inventors of the invention being claimed in the above-identified patent application;
2. I have read and understand the Office Action mailed July 14, 2004 by the Patent and Trademark Office in the above-identified application and the art being applied therein, namely U.S. Pat. Nos. 6,387,523 to Bunyan et al. and 6,147,017 to Fastenau et al.;
3. I have conducted the following experiments which demonstrate the facts that the EMI shielding performance is attained by using a fabric constructed of flat multifilament yarn composed of a plurality of flat

thermoplastic single filaments, the warp of said fabric having a fabric surface occupancy ratio of 60 to 90%, its weft having a fabric surface occupancy ratio of 90 to 120% for a metal coating treatment.

#### Example 2

A plain weave fabric with 30d-18f polyester multifilament yarn (composed of singlefilament with a W-shaped cross-section, whose circumscribed rectangle has a long side (L) of 35  $\mu$ m and a short side (S) of 15  $\mu$ m - Asahi Chemical-made Technofine) for its warp and 50d-30f polyester multifilament yarn (composed of singlefilament with a W-shaped cross-section, whose circumscribed rectangle has a long side (L) of 35  $\mu$ m and a short side (S) of 15  $\mu$ m - Asahi Chemical-made Technofine) for its weft was scoured, dried and heat-preset before being caustic treatment for weight reduction by 10% to convert the fabric into one with a warp density of 149 yarns/inch, a weft density of 138 yarns/inch and a cover factor of 1792.

The fabric was immersed in an aqueous solution containing 0.3g/L of palladium chloride, 30g/L of stannous chloride and 300ml of 36% hydrochloric acid and then washed with water. Thereafter, the fabric was immersed in a solution of borofluoric acid with an acid concentration of 0.1N and then washed with water. The fabric was subsequently

immersed in an electroless copper plating bath consisting of 7.5g/L of copper sulfate, 30ml/L of 37% formalin and 85g/L of Rochelle salt and then washed with water. The copper-plated fabric was further immersed in an electroplating bath consisting of 300g/L of nickel sulfamate, 30g/L of boric acid and 15g/L of nickel chloride at a pH of 3.7 with a current density of 5A/dm<sup>2</sup> to build up a nickel layer on it before washing it with water to obtain an electrically conductive material with a metal coating layer consisting of 25g/m<sup>2</sup> of copper and 5g/m<sup>2</sup> of nickel. The metal coated material was subjected to the above-mentioned evaluation, the result of which is as shown in Table 2.

#### Comparative Examples 2-5

The above Example 2 were repeated excepting that the warp density, weft density and cover factor were changed as shown in Table 2. The results are as shown in Table 2.



Table 2

	Ex. 1	Ex. 2	Com.Ex.1	Com.Ex.2	Com.Ex.3	Com.Ex.4	Com.Ex.5
Fabric thickness ( $\mu\text{m}$ )	75	80	120	77	100	78	80
Yarn total deniers/ Number of filaments(d/f)	50/24 75/36	30/18 50/30	50/36 50/36	30/18 50/30	30/18 50/30	30/18 50/30	30/18 50/30
Density (number/inch)	123 84	149 138	164 104	110 108	224 110	148 95	169 183
Cover factor	1597	1792	1895	1366	2005	1482	2220
Average flat ratio of filament	1.0 2.3	2.3 2.3	1.0 1.0	2.3 2.3	2.3 2.3	2.3 2.3	2.3 2.3
Average flat ratio of yarn	2.9 5.9	3.6 5.0	2.0 3.2	3.8 5.2	2.0 5.3	3.7 5.2	3.8 4.0
Fabric surface occupancy ratio (%)	76 92	69 119	86 70	52 93	97 95	70 82	80 130
Surface conductivity ( $\Omega/\square$ )	0.015	0.036	0.056	0.053	0.040	0.054	0.042
EMI shielding Performance (dB)	100 97 91 83 82 80 84 78	102 92 85 76 75 70 74 74	96 83 76 66 65 60 63 63	95 85 80 75 68 64 67 65	97 80 75 65 64 62 65 65	96 82 73 68 65 65 63 61	98 83 80 67 66 63 65 64
Flexibility (mm) (warp/weft)	55/42	37/37	75/45	39/40	50/40	40/40	47/50



As can be seen from Table 2, if the fabric constructed of multifilament yarn composed of flat singlefilaments does not meet the defined fabric surface occupancy ratio, the EMI shielding performance cannot be improved; and

4. All statements made herein of my own knowledge are true and all statements made on information and belief are believed to be true; and further these statements are made with knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and such willful false statement may jeopardize the validity of the application or any patent issued thereon.

October 8, 2004  
Date

Susumu Takagi  
Susumu Tagagi